1. Complete the Borda Method on the preference schedule below. Is there anything that bothers you about the winner?

	21	10	9
3 pts 1st	A	B	B
2 pts 2nd	B	C	C
1 pt 3rd	C	A	A

$A = 3(21) + 1(10) + 1(9) = 82$

$B = 2(21) + 3(10) + 3(9) = 99$ ← B wins under Borda Count!

$C = 1(21) + 2(10) + 2(9) = 59$

Total # of voters = 40

majority = 21

1st choice votes $A = 21$ ← A has a majority of 1st choice votes!
$B = 19$
$C = 0$

Majority Criterion

A candidate who receives a majority of 1st place votes should win the election!

2. (Example 11) Below is a preference schedule (left) and one-to-one comparisons (right).

	5	5	6	4
1st	D	A	C	B
2nd	A	C	B	D
3rd	C	B	D	A
4th	B	D	A	C

A vs B: 10 to 10   ← tie
A vs C: 14 to 6   ← A wins
A vs D: 5 to 15   ← D wins
B vs C: 4 to 16   ← C wins
B vs D: 15 to 5   ← B wins
C vs D: 11 to 9   ← C wins

Copeland
$A = \frac{1}{2} + 1 = \frac{3}{2}$
$B = \frac{1}{2} + 1 = \frac{3}{2}$
$C = 2$
$D = 1$

C wins under Copeland's Method.

Suppose candidate D wasn't there?

	5	5	6	4
1st	~~D~~	A	C	B
2nd	A	C	B	~~D~~
3rd	C	B	~~D~~	A
4th	B	~~D~~	A	C

A v B   10 to 10   tie
A v C   14 to 6   A wins
B v C   4 to 16   C wins

Copeland
$A = \frac{1}{2} + 1$
$B = \frac{1}{2}$
$C = 1$

$\underline{A}$ wins!

Independence of irrelevant alternatives

- If you eliminate a non-winning candidate from the ballot it shouldn't change the outcome of the election, or

- If candidate X is preferred over candidate Y, that shouldn't change just because candidate Z is included

3. Recap of **Fairness Conditions**

Condition	Pass	Fail
IIA		Copeland, Borda, IRV, Plurality
Majority	IRV, Copeland, Plurality	Borda
Monotonicity	Copeland, Plurality, Borda	IRV
Condorcet	Copeland *	Plurality, IRV, Borda

(Wikipedia has a great chart — see Borda Count article)

Arrow's Impossiblity Theorem

You can't have a voting method that satisfies <u>all</u> the fairness conditions simultaneously!

4. Approval Voting

	30	15	10	10
Anchorage	X	X		
Bettles	X		X	X
Chevak		X		X

Voters vote for all the choices they approve of!

Count the total # of approvals

X = approve
☐ = disapprove

A = 30 + 15 = 45

B = 30 + 10 + 10 = 50   ← winner

C = 15 + 10 = 25

✳ Vulnerable to insincere voting!

If the 30 voters in column 1 <u>only</u> vote for A (because they prefer A to B) then they will guarantee A wins (even though they in reality are also ok with B)

2

Red Pen Quiz Corrections

Instructions

You are encouraged to talk to your classmates and compare your quizzes!

1. Put everything away except your quiz and a calculator

2. Come get a red pen

3. **Circle** your error. **Do not scribble out!**

4. **Write** what your error was

5. **Fix** your error, including showing supporting work/calculations if necessary.